UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/020,719	10/30/2001	Eric R. Bachmann	NC#82816/NPS1P001	9622

7590 08/21/2003

Superintendent
Office of Counsel Code 00C
Naval Postgraduate School
1 University Circle, Rm. 12
Monterey, CA 93943-5000

EXAMINER
LE, TOAN M

ART UNIT	PAPER NUMBER
2863	

DATE MAILED: 08/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/020,719	Applicant(s) BACHMANN ET AL.	
	Examiner Toan M Le	Art Unit 2863	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *5/19/03* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-44* is/are pending in the application.

4a) Of the above claim(s) *31-43* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-30 and 44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4,6* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Applicant's election of Species I in Paper No. 7 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-30 and 44 are rejected under 35 U.S.C. 102(b) as being anticipated by "A Computer Simulation Study and Component Evaluation for a Quaternion Filter for Sourceless Tracking of Human Limb Segment Motion", Henault (Referred hereafter Henault).

Referring to claims 1 and 8, Henault discloses a method of tracking the orientation of a sensor, the method comprising: a) measuring an angular velocity of the sensor to generate angular rate values/angular rate quaternion (page 26, lines 13-14; figure 8); b) integrating the angular rate values/angular rate quaternion (page 26, lines 14-15; figure 8); c) normalizing the integrated angular rate values/angular rate quaternion to produce an estimate of sensor orientation (figure 8); d) measuring a magnetic field vector to generate local magnetic field vector values (page 26, line 17; figure 9); e) measuring an acceleration vector to generate local gravity vector values (page 26, lines 9-13; figure 9); f) and correcting the estimate of sensor orientation using the local magnetic field vector and local gravity vector (page 26, lines 17-20; figure 8).

As to claims 2 and 9, Henault discloses a method of tracking the orientation of a sensor, wherein correcting the estimate of sensor orientation/estimated sensor orientation quaternion using the local magnetic field vector and local gravity vector comprises: g) determining a measurement vector from the local magnetic field vector values and the local gravity vector values (page 28, equations 3.21, 3.22, and 3.23; figures 8-9); h) calculating a computed measurement vector from the estimate of sensor orientation (page 29, equation 3.24); i) comparing the measurement vector with the computed measurement vector to generate an error vector that defines a criterion function (page 29, equations 3.25 and 3.26); j) performing a mathematical operation that results in the minimization of the criterion function and outputs an error estimate (page 29, second half; page 30, first half; figure 8); k) integrating the error estimate (figure 8); l) normalizing the integrated error estimate to produce a new estimate of sensor orientation (page 31, first half; figure 8); m) and repeating steps a)-m), wherein the new estimate of sensor orientation is used for h), calculating a computed measurement vector until tracking is no longer desired (figure 8).

Referring to claims 3, 10, 17, and 24-25, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4x1 quaternion error estimate comprises minimizing the criterion function without calculating the criterion function (page 34, equation 4.2) and multiplying the 6x1 error vector by the function $[X^TX]^{-1}X^T$ (equation 4.2).

As to claims 4, 11, 18, and 26, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the

criterion function and outputs a 4x1 quaternion error estimate includes implementing a partial correction step to compensate for measurement error (page 35, equation 4.4).

Referring to claims 5, 12, 19, and 29, Henault discloses a method of tracking the orientation of a sensor, wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements (page 34, first half; equation 4.4).

As to claims 6, 13, 20, and 27, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4x1 quaternion error estimate comprises using time weighted filtering (page 35, equation 4.4).

Referring to claims 7, 14, 21, and 28, Henault discloses a method of tracking the orientation of a sensor, wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4x1 quaternion error estimate comprises using a Gauss-Newton iteration (pages 41-42, figures 15-17).

As to claims 15 and 23, Henault discloses a method of tracking the orientation of a sensor, the method comprising: a) providing a starting estimate of sensor orientation (figure 8); b) measuring a magnetic field vector to generate local magnetic field vector values (page 26, line 17; figure 9); c) measuring an acceleration vector to generate local gravity vector values (page 26, lines 9-13; figure 9); d) determining a measurement vector from the local magnetic field vector values and the local gravity vector values (page 28, equations 3.21, 3.22, 3.23; figures 8-9); e) calculating a computed measurement vector from the estimate of sensor orientation (page

29, equation 3.24); f) comparing the measurement vector with the computed measurement vector to generate an (6x1) error vector that defines a criterion function (page 29, equations 3.25 and 3.26); g) performing a mathematical operation that results in the minimization of the criterion function and outputs a (4x1) error estimate (page 29, second half; page 30, first half; figure 8); h) integrating the error estimate (figure 8); i) normalizing the integrated error estimate to produce a new estimate of sensor orientation (page 31, first half; figure 8); and j) repeating steps a)-j), wherein the new estimate of sensor orientation is used for e), calculating a computed measurement vector (figure 8).

Referring to claim 16, Henault discloses a method of tracking the orientation of a sensor, wherein each new estimate of sensor orientation is output as a sensor orientation signal (figure 8).

As to claims 22 and 30, Henault discloses a method of tracking the orientation of a sensor wherein performing a mathematical operation that results in the minimization of the criterion function and outputs a 4x1 quaternion error estimate includes: measuring an angular velocity of the sensor to generate angular rate values (page 26, lines 13-14; figure 8); integrating the angular rate values (page 26, lines 14-15; figure 8); normalizing the integrated angular rate values to produce an estimate of sensor orientation derived from the angular rate values (figure 8); and using the estimate of sensor orientation derived from the angular rate values to correct for time lag (page 26, lines 17-20).

Referring to claim 44, Henault discloses a method of determining the direction of a local gravity vector with an acceleration detector, the method comprising: moving the acceleration detector from a start point to an end point over a time period; taking measurements of the total

acceleration vector during the time period; weighting summing the measurements of the total acceleration vector over the time period; and calculating gravity vector values using the weighted sum of the total acceleration measurements (page 26, lines 7-13).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,377,906 to Rowe

U.S. Patent No. 6,427,131 to McCall et al.

U.S. Patent No. 6,148,280 to Kramer

U.S. Patent No. 5,807,284 to Foxlin

U.S. Patent No. 5,953,683 to Hansen et al.

U.S. Patent No. 5,645,077 to Foxlin

U.S. Patent No. 6,428,490 to Kramer et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toan M Le whose telephone number is (703) 305-4016. The examiner can normally be reached on Monday through Friday from 9:00 A.M. to 5:30 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Barlow can be reached on (703) 308-3126. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0655.

Toan Le

August 11, 2003

John Barlow
Supervisory Patent Examiner
Technology Center 2800